

COST-UTILITY OF BURNS MANAGEMENT IN NIGERIA: A CASE STUDY OF THE NATIONAL ORTHOPAEDIC HOSPITAL, ENUGU

ÉTUDE MÉDICO-ÉCONOMIQUE DE LA PRISE EN CHARGE DES BRÛLÉS AU NIGERIA: LE CAS DE L'HÔPITAL ORTHOPÉDIQUE NATIONAL D'ENUGU

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SUMMARY. A major problem of burns is the high cost of management, as well as the discrimination and disability they can cause to patients. Maximising resource utilisation is of key importance for lower-middle-income countries (LMICs) like Nigeria. There is a need to know if Nigerian patients who were victims of burns get the best value for money. This study aimed to evaluate the average cost of managing burns in Nigeria, and determine if the treatment approach is cost-effective. The study was a cost-utility analysis from the perspective of health service providers in Nigeria, a case study of the National Orthopaedic Hospital Enugu (NOHE) using 2013 Microsoft excel. Data on the cost of burn management were obtained from a retrospective study conducted in NOHE in 2012 on 285 patients. Costs were adjusted to reflect the future (2015) value using a real interest rate of 3%. These costs were presented in 2015 US dollars, and a discount rate of 3% was used for both cost and outcome. Health outcome was presented in disability adjusted life years (DALYs). Based on a cost-effectiveness threshold of \$2,758.4 (i.e. representing Nigerian GDP/capita), burn management is cost-effective in Nigeria (\$526.68/DALY averted). The result also showed that the cost of managing burns in Nigeria is \$7,123.28 per patient, which is more than the average income. Burn management in Nigeria is cost-effective but too expensive for most Nigerians to afford.

Keywords: burns, Nigeria, cost-utility, management, disability adjusted life years (DALYs)

RÉSUMÉ. Un des problèmes de la prise en charge des brûlés est son coût, ainsi que la discrimination et le handicap que la brûlure peut entraîner. L'optimisation des ressources financières est d'une importance cruciale dans les pays en développement comme le Nigeria et il est nécessaire de savoir si les finances engagées se révèlent utiles. Cette étude a pour but d'évaluer le coût de prise en charge des brûlés au Nigeria, et d'évaluer l'efficacité du traitement, à partir des données de l'Hôpital Orthopédique National (HON) d'Enugu. Les données des 285 patients hospitalisés dans l'HON pour brûlures en 2012 ont été analysées. Les chiffres de 2012 ont été extrapolés à 2015 en tenant compte d'une inflation de 3%. L'état de santé après traitement a été chiffré en Espérance de Vie Corrigée de l'Incapacité (EVCI). Le coût de traitement d'une brûlure est de 7 123,28\$ soit 526,68\$ par année d'ECVI gagnée et la prise en charge des brûlés apparaît donc utile, en termes médico-économiques. Ce coût est cependant à rapporter au PIB per capita du Nigeria, qui est de 2 758,40\$. La prise en charge des brûlés au Nigeria, bien que trop chère pour la plupart des nigériens, est efficace financièrement.

Mots-clés: brûlure, Nigeria, prise en charge, médico-économique, espérance de vie corrigée de l'incapacité

Introduction

Burns continue to be a global challenge. Annually, they cause over 265,000 deaths.¹ Burns are the fourth most common type of trauma worldwide, following traffic accidents, falls and interpersonal violence.^{2,3} Most cases of burns occur in low- and middle-income countries (LMICs) like Nigeria. Non-fatal burns are a leading cause of morbidity, prolonged hospitalization, disfigurement and disability.¹ They are also a major cause of disability-adjusted-life-years (DALYs) in LMICs.

In high income countries, efforts have been made to reduce

the rate of burn cases through prevention activities and treatment modalities.⁴ This achievement has been supported by the development of surveillance systems, legislation, social marketing and advocacy. Better resuscitation, burn care, skin grafting, control of infection and rehabilitation has been achieved in high-income countries. However, these improvements have not been possible in LMICs, including Nigeria. Ignorance and poverty have been strongly linked to this lack of achievement and high incidence rate in Nigeria.⁵ Although this type of injury is preventable, advances in prevention and care have not been fully implemented in the country.

A major problem of burns is the high cost of management,

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as well as the discrimination and disability they can cause to patients. In Nigeria, burn care is expensive for citizens.^{6,7,8} The economic burden of burns cannot be overemphasized. In 2000, direct costs for the care of children with burns in the United States of America exceeded US\$ 211 million. In Norway, costs for hospital burn management in 2007 exceeded €10.5 million.¹ Although Nigeria's data is not yet available, it might be astonishing to know how much is spent annually on managing burns in Nigeria when the average cost per day of managing a patient is \$44.28 and average length of hospital stay is 3.2 months.⁹

Most studies on burn management in Nigeria and other countries have pointed out the high cost of managing burn patients.^{9,10,11} Maximising resource utilisation is of key importance for a lower-middle-income country like Nigeria. There is a need to know if Nigerian burn patients get the best value for money. There is also a need to know if the cost of managing burns exceeds the Nigerian per capita income and hence requires governmental and non-governmental assistance. It will also be worthwhile to determine if the treatment system in Nigeria is cost-effective. This study used retrospective data from the National Orthopaedic Hospital Enugu (NOHE) to conduct a cost-utility analysis of burn management in the hospital from the payer's perspective.

Methods

Study setting and perspective

The study was a cost-utility analysis from the perspective of health service providers in Nigeria. The study was carried out in Enugu at the NOHE.

Data collection

Management cost data were obtained from a retrospective study in the NOHE.¹¹ Data on mortality rate (resulting from management), prevalence and total body surface area (TBSA) burned were also obtained from studies in the NOHE.^{5,11} Data on average duration of hospital stay and crude mortality were

obtained from studies in the National Orthopaedic Hospital Ig-bobi Lagos (NOHIL) and Ile-Ife, Nigeria.^{12,9}

Determination of cost

Data on the cost of burn management were obtained from a retrospective study conducted at NOHE in 2012 on 285 patients.¹¹ Cost was estimated from the payer's perspective. It included direct medical and non-medical costs. These comprised haematology tests, microbiology tests, clinical chemistry, antibiotics, other medications including oxygen and other hospital bills (including surgery). A mean duration of hospital stay/management in Nigeria of 92 days was obtained from a study in NOHIL.⁹ The cost of loss of productivity was obtained from Nigerian national minimum wage data.¹³ Costs for both the management scenario and 'no treatment' scenario were analysed.

Costs were adjusted to reflect future (2015) value using a real interest rate of 3% (range of 0% - 5%).¹⁴ Costs in Naira were divided by the yearly exchange rate to obtain the US dollar equivalent.¹⁵ They were presented in 2015 US dollars and a discount rate of 3% was used for both cost and effect. Triangular distribution was used to capture the uncertainty inherent in the cost parameter and the average cost of managing a patient was obtained.

Presenting health outcome

Health outcome was presented in disability adjusted life years (DALYs). DALY was calculated by combining years lived with disability (YLD) and years of life lost (YLL). The DALY calculation was based on the recent Global Burden of Disease 2010 study¹⁶ and using recently updated disability weights.¹⁷ A standard life expectancy at birth of 53 years was obtained from the 2013 Nigerian life table.¹⁸

YLD = Number of cases* duration till remission or death* disability weight.^{16,19} YLL was calculated by the formula, YLL = Number of deaths due to burns* life expectancy at the age of death.¹⁹

Mortality rate from burns management and mortality rate from 'no treatment' was obtained from studies in the NOHE and Ile-Ife, Nigeria.^{5,12} YLD and YLL for 285 patients were obtained and then averaged to obtain a per patient value. DALY lost per patient was calculated by summing the YLL and YLD. DALY averted was calculated as the difference between 'no treatment' DALYs and DALYs for management. Prevalence and mortality are shown in *Table I*. Population data and other input parameters are shown in *Table II*.

Table I - Mortality rate and frequency of burns

% TBSA	Prevalence	Mortality	Source
0 < 20	174	nil	[5]
≥ 20	111	58	[5]

Table II - Parameter input and distribution

Variables	Mean/Mode	Distribution	Source
No. of patients	285	N/A	[5]
Standard life expectancy at birth	53 years	N/A	[18]
Disability weights			
<20% burns with treatment	0.016	Beta (0.008 - 0.028)	[17]
≥20% burns with treatment	0.135	Beta (0.092 - 0.190)	[17]
<20% burns without treatment	0.141	Beta (0.094 - 0.196)	[17]
≥20% burns without treatment	0.455	Beta (0.302 - 0.601)	[17]
Prevalence			
<20% burns	0.318	N/A (0.086 - 0.636)	[5]
≥20% burns	0.432	N/A (0.015 - 0.864)	[5]
Mortality rate with treatment	0.232	N/A (0.064 - 0.402)	[11]
Mortality rate without treatment	0.635	N/A (0.131 - 1.174)	[12]
Discount rate	0.03	N/A (0.00 - 0.05)	[14]

Table III - Mortality and YLL based on age distribution

Age	Mean age	Total patients	Management		No treatment	
			Mortality	YLL*	Mortality	YLL*
0 – 10	5.0	110	42.45	2037.83	84.21	4041.97
11 – 20	15.5	40	15.44	578.93	30.62	1148.29
21 – 30	25.5	51	19.68	541.30	39.04	1073.65
31 – 40	35.5	40	15.44	270.17	30.62	535.87
41 – 50	45.5	31	11.96	89.73	23.73	177.98
≥ 51	53	13	5.02	0	9.95	0

*YLL = Years of Life Lost

Table IV - Incremental cost-effectiveness ratio result

Interventions	Cost (\$)	DALYs lost	Incremental cost against 'no treatment'	DALYs averted against 'no treatment'	ICER [95% confidence interval] (\$/DALYs averted)
No treatment	423.59	20.12	—	—	—
Burns management	7128.28	7.39	6704.69	12.73	526.68 [378.12 – 675.06]

Handling uncertainty

Distributions appropriate for each variable were employed in order to capture the varying degree of inherent uncertainty in the variables used in the analysis (*Table I*). Probabilistic sensitivity analysis was used to assess simultaneous uncertainty in the variables. This approach is well suited to expressing overall model uncertainty.²⁰ A total of 1000 iterations of Monte Carlo simulations was conducted and for each iteration a value was drawn randomly from each distribution and the mean and confidence interval calculated.²⁰

Incremental cost-effectiveness ratio (ICER)

ICER presents the additional benefit when extra money is invested to cross over from one intervention to another. The incremental cost and effect as a crossover is made from 'no treatment' to burns management is calculated and used to calculate the ICER. Average incremental cost-effectiveness ratios (mean ICERs) with their 95% confidence interval from the 1000 iterations were calculated. Average ICERs (with 95% confidence interval) are presented in *Table II*.

Analyses were carried out using 2013 Microsoft Excel.

Results

The results showed that the average cost of managing burns in Nigeria was \$7123.28 (7044.49–7207.06) per patient. Loss of productivity for the average period of hospitalization was \$433.75 (350.32–525.47). Average YLD and YLL per patient was 0.073 and 12.13 respectively. YLL was calculated from mortality as shown in *Table III*.

DALY averted after management was 12.73, while ICER against 'no treatment' was \$526.68/DALY. ICER results are shown in *Table IV*.

Discussion

This study aimed to identify whether the management approach to burn patients is cost-effective, and evaluate the cost of managing burns to establish whether or not it is affordable for Nigerians. Results showed that the cost of managing burns in Nigeria is high (\$7128.28), which is above the GDP per capita. The minimum wage in Nigeria is \$90 per month, which is equivalent to \$276 for 92 days (mean management period).

In most cases, parents or caregivers cannot afford to pay their hospital bills, which could lead to the cessation of treatment, increasing the risk of morbidity and mortality. The high cost of management is a global challenge that needs immediate response. Although burn care is not a primary target of goal 4 or goal 6 of the Millennium Development Goals (MDGs), it has a place in target 4.1 (under five mortality rate)²¹ since our statistical findings showed that 38.6% of burns in Enugu occur in children under 10 years old.

ICER for management of burns (\$526.68/DALY) was less than the GDP per capita of Nigeria, which was US\$2,758.4 in 2015.²² Thus, the management approach can be judged as being cost-effective.

Level of burn safety knowledge has been shown to be low in Nigeria.^{23,24} Support from donor agencies and government will aid health campaigns in communities and advertising on television and the radio, as well as the education of parents, youths and children.

Most studies on burn management analysed only the cost of management and have shown that management costs are high.²⁵ Studies involving cost-utility analyses of burn care are scarce. While most studies analysed the cost of management from several perspectives, this study is, to the best of our knowledge, the first cost-utility analysis of burn management in an African setting.

One major limitation of this study is that it used retrospective data from only two orthopaedic hospitals. Unavailability of some data was also a constraint.

More studies on cost-effectiveness or cost-utility in burn management need to be conducted in other parts of Africa to provide better conclusive evidence about its management effectiveness.

As the management approach appears cost-effective although expensive for most Nigerians, there is a need for the Nigerian government and other health organisations to consider supporting burn patients, especially those with over 20% TBSA burned and second and third degree burns.

Conclusion

Burn management in Nigeria is cost-effective, although it is expensive for most Nigerians. The Nigerian government, health organisations and non-governmental organisations

should consider supporting burn patients as this will speed up their recovery and wellbeing. Support through education and

health campaigns is also necessary as this will help to reduce incidence rate.

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Conflict of Interest. The authors declare no conflict of interest.